COWPEAS: CULTURE AND VARIETIES.

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CONTENTS.

	Page.		Page.
History of the cowpea	3	Method and rate of sowing	14
Climatic adaptations	4	Cultivation	16
Soil relations	5	Cowpeas in rotations	16
Varieties	6	Cowpeas in mixtures	18
Fertilizers	11	Diseases of the cowpea	21
Preparation of the seed bed	12	Insect enemies of the cowpea	23
Inoculation	12	Cowpeas, soy beans, and velvet beans compared	25
Time of sowing	13		

HISTORY OF THE COWPEA.

THE COWPEA[1] (fig. 1) is undoubtedly a native of Central Africa. A wild plant differing little from the cultivated cowpea occurs throughout much of that continent.[2] Hybrids of this wild plant and the cultivated cowpea are readily obtained. The cultivated cowpea consists of three main groups—the asparagus bean,[3] the catjang,[4] and the cowpea,[1] each of which represents a group of varieties having much in common but connected through intermediate varieties. The cowpea is the most important of the three groups.

The large number and great diversity of cultivated varieties throughout Africa and over the southern half of Asia and the adjacent islands as well as the Mediterranean region of Europe indicate that the cowpea is of ancient cultivation for human food. It was early introduced in the Spanish settlements in the West Indies and was grown in North Carolina in 1714, probably coming from the West Indies. Its culture in Virginia was reported about 1775 and no doubt was quite general in the United States early in the nineteenth century.

Without doubt, the cowpea is the Phaseolus mentioned by the old Roman writers. In Italy the Blackeye cowpea is still called by the

[1] *Vigna sinensis.*

[2] Piper, C. V. The wild prototype of the cowpea. *In* U. S. Dept. Agr., Bur. of Plant Indus. Circ. 124, p. 29–32. 1913.

[3] *Vigna sinensis* var. *sesquipedalis.*

[4] *Vigna sinensis* var. *cylindrica.*

same name as the kidney bean, namely, "fagiolo," which is the Italian equivalent of Phaseolus. In East Africa both the wild and cultivated cowpeas are called "kunde," while in India, where the catjang is more extensively cultivated, the name "lubia," with many others, is used. In America the cowpea was first known as "callivance" and later as "Indian pea," "southern pea," "southern field pea," and "cornfield pea." The first published record of the name cowpea was in 1798 and applied apparently to a single variety.[5]

FIG. 1.—Cowpea plant (*Vigna sinensis*), showing mature pods.

The cowpea at present is the best known and most extensively grown leguminous crop in the Southern States, but it can be grown profitably much farther North. Although it succeeds under a greater diversity of climatic, soil, and cultural conditions than most other legumes, the best results are obtained in forage, soil improvement, and seed production by a thorough understanding of the requirements and the best varieties of the crop.

CLIMATIC ADAPTATIONS.

The cowpea is a warm-weather crop; therefore it has the greatest value in the Southern States, gradually lessening northward. (Fig. 2.) It is grown successfully, however, in the southern parts of Ohio, Illinois, Indiana, and New Jersey, and in parts of Michigan. In gen-

[5] The writings of Thomas Jefferson, Monticello edition, v. 10, p. 12. Washington, D. C. 1904.

eral, the cowpea is adapted to about the same climatic conditions as corn, but it requires somewhat more heat. It will withstand a considerable degree of drought, but under very dry conditions will produce only a moderate quantity of hay and a very small number of seeds, if any. Both in spring and in fall the leaves are injured by the least touch of frost, and a heavy frost is always fatal. The cowpea withstands moderate shade sufficiently well to be valuable in orchards. In heavy shade the plants are usually much attacked by mildew.

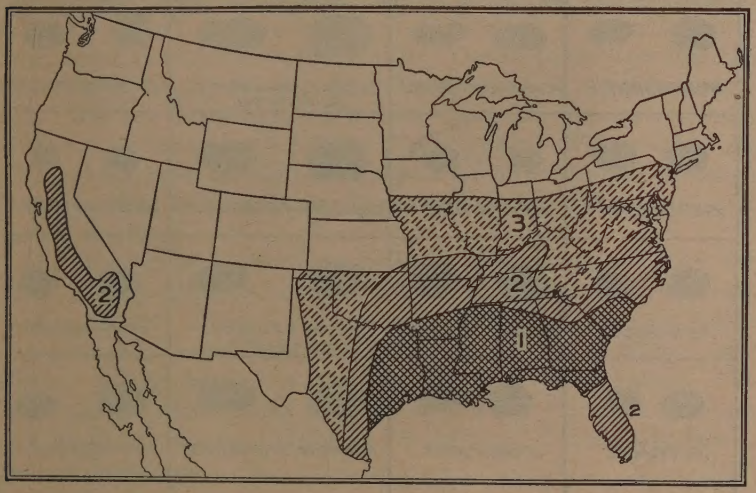

FIG. 2.—Outline map of the United States, showing the comparative distribution of cowpeas. 1, Area in which cowpeas are grown most extensively; 2, area in which cowpeas are grown quite generally; 3, area in which cowpeas are grown to some extent.

SOIL RELATIONS.

The cowpea succeeds on practically all types of soil. It does apparently quite as well on sandy soils as on heavy clays, but will do better than clover or alfalfa on thin soils or soils that are poor in lime. No other legume can be grown so successfully and on such a variety of soils under adverse conditions as the cowpea. A very rich soil is not conducive to the best results with this crop. On such a soil an abundant vine growth is produced, while the yield of grain is small. Poor soils will produce little growth of vine, but will generally yield a good proportion of seed. Clay soils will not produce a heavy yield the first year, but the crop will succeed much better the second season. It may be said that the cowpea will do best on good corn land, but will thrive on all types of soil that are well drained, properly inoculated, and moderately rich.

VARIETIES.

In the selection of a cowpea variety the characters most desirable both for forage and for seed need to be considered. The variety should be suited to local conditions and to the purpose for which the crop is grown. The characteristics most important in considering the cowpea for forage are (1) size and vigor; (2) habit, especially erectness; (3) prolificacy, the pods being well filled and held well

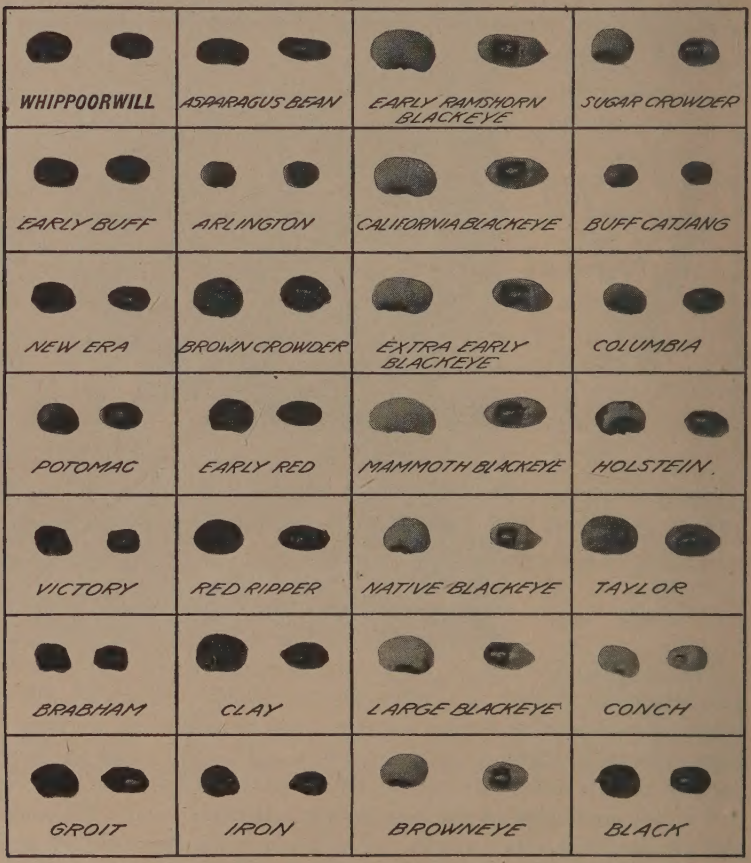

FIG. 3.—Seeds of the most important varieties of cowpeas.

above the ground; (4) disease resistance; (5) ability to retain leaves late in season; (6) time of maturity; and (7) evenness of maturity. Toward the northern part of the cowpea region early maturity is desirable. For planting in corn or sorghum a strong viny habit is of importance. When grown for human food or to be pastured, the yield of pods and seeds needs special consideration.

Most varieties of cowpeas under different conditions of soil or climate exhibit marked fluctuations. On rich soil or when planted early the general tendency is to produce a large growth of vine and but few pods. Usually moist seasons have the same effect. On poor land, especially sandy soils, or when sown late, the plants tend to produce much more seed but less herbage. Moderate drought has a very similar effect, but very severe drought prevents most varieties from producing pods.

At present about 15 varieties (fig. 3) of cowpeas are in common cultivation, while the varieties grown in a small way number, perhaps, about three times as many more. Owing to the fact that the seed is still largely hand picked, the tendency is for the variety which was first introduced in a locality to persist; therefore varieties of relative inferiority are still too largely grown. The varieties are distinguished most readily by the color and size of the seed, although they also differ in habit, length of growing period, yield of seed, and disease resistance.

The most valuable American varieties of cowpeas for forage are the Whippoorwill, Iron, and New Era and their hybrids, the Brabham and Groit. Important, but of secondary value, are such indefinite groups of varieties as the Unknown, Clay, Red Ripper, and Black. A large number of others are grown to a small extent. For table use, the white-seeded varieties, such as the Conch and Cream, and the Blackeye sorts, California Blackeye and Extra Early Blackeye, are preferable.

DESCRIPTIONS OF NEW OR IMPORTANT VARIETIES AND GROUPS OF VARIETIES.

Whippoorwill.—The Whippoorwill, also known as Shinney and Speckled, is one of the old standard sorts and the one most commonly grown. It is a good general-purpose variety and suitable for grain or hay production. Plants tall, suberect, half bushy, prolific; pods held high, the first maturing in about 85 days; seeds buff, marbled with brown.

New Era.—The New Era is one of the important commercial varieties of cowpeas. It is especially valuable on account of its earliness, its erectness, and the smallness of the seed. It usually produces a heavier yield of seed than the Whippoorwill. Plants tall, erect, half bushy, very prolific; pods held high, the first maturing in about 75 days; seeds buff, thickly and evenly speckled with blue.

Groit.—The Groit cowpea is a natural cross between the New Era and Whippoorwill varieties. It has been much confused with the New Era, but in general is from 20 to 25 per cent better and is largely replacing it. Plants suberect, half bushy, very prolific; pods held high, the first maturing in about 80 days; seeds with a ground color

of buff, marbled with brown and thickly sprinkled with minute blue specks.

Brabham.—The Brabham cowpea originated as a natural cross between the Iron and Whippoorwill varieties. It has the tall habit and prolificacy of the Whippoorwill with the resistance to wilt and root-knot of the Iron variety. The Brabham is especially adapted to the sandy soils of the South where wilt and root-knot prevail. Plants tall, half bushy, very prolific; pods held high, the first maturing in about 90 days; seeds buff, marbled with brown.

Iron.—The Iron variety is especially valuable on account of its immunity to root-knot and wilt and is largely grown where these diseases prevail. The Iron is not a heavy yielder of seed. It has harder seed, volunteers more readily, and retains its vitality better than other sorts. Plants tall, half bushy, moderately prolific; pods held medium high, the first maturing in 90 to 100 days; seeds cream buff to vinaceous buff.

Victor.—The Victor is an artificial cross between the Brabham and Groit varieties originated by the United States Department of Agriculture. It has the tall habit of the Brabham and has given better results in yields of hay and seed than either parent. It is valuable for both forage and seed, especially in the Piedmont and Coastal Plain areas of the cowpea region. Its resistance to wilt and nematode attacks is as high as that of the Iron and Brabham varieties. Plants tall, half bushy, very prolific; pods held high, the first maturing in about 90 days; seeds small, of the Brabham shape, buff, marbled with brown, and sprinkled with minute blue specks.

Arlington.—The Arlington cowpea is a cross originated by the United States Department of Agriculture. It is suberect, bushy, very prolific, and adapted to about the same region as the Groit variety; pods held high, the first maturing in about 80 days; seeds white, with a Whippoorwill eye.

Columbia.—The Columbia cowpea is an artificial cross between a blackeye variety and the Red Whippoorwill, originated by the United States Department of Agriculture. This variety is adapted to about the same regions and conditions as the Groit and is of about the same value in habit, forage, and seed yield. Plants suberect, half bushy, very prolific; pods held high, the first maturing in about 85 days; seeds white, with a maroon eye.

Taylor.—The Taylor variety, known in various localities as the Gray Goose, Gray Crowder, Whittle, and Speckled Java, has the largest seeds of all cowpeas handled by growers and seedsmen in this country. In many sections the Taylor is considered a valuable variety, but in general its habit of growth is low and the pods are held so near the ground that it is practically impossible to harvest them with a mower. Plants low, half bushy, prolific; pods held low, the first

maturing in about 90 days; seeds buff, thickly speckled with blue, the blue specks arranged in groups.

Early Buff.—The Early Buff cowpea is one of the earliest and one which has proved to be valuable in the northern part of the cowpea region. Plants suberect, bushy, very prolific; pods held medium high, the first maturing in about 60 days; seeds buff or pinkish buff.

Michigan Favorite.—The Michigan Favorite variety, known also as the New Revenue and Revenue, has been grown, on account of its earliness, to a considerable extent in Illinois, Indiana, and Michigan. It is also grown for table use to some extent southward, especially in Texas. Plants low, half bushy, prolific; pods held low, the first maturing in about 85 days; seeds buff-pink, Crowder form.

Early Red.—The Early Red is a good medium-early variety adapted to about the same region as the Early Buff. Plants half bushy, prolific; pods held medium low, the first maturing in about 75 days; seeds pale red.

Clay.—The term Clay is applied commercially to a group of medium-late varieties with buff-colored seed rather than to any one sort. The Iron cowpea is not included in the Clay group. There are many buff-seeded varieties, all of which have practically the same habit of growth, but they differ slightly in time of maturity, size, and form of seeds. Those sorts which mature their first pods in about 110 days or less make up most of the seed sold as Clay, while the sorts requiring 110 days or more to mature the first pods are called Wonderful or Unknown. On account of its large vigorous growth, the Clay group, especially the Unknown or Wonderful, is grown to a considerable extent for forage and soil improvement.

Red Ripper.—Red Ripper is a group name, like Clay, which is applied to all varieties with maroon seeds rather than to any one sort. Practically all of this group have much the same habit, differing mainly in earliness and seed characteristics. None of them are especially valuable, though in a few sections of the South they are grown for soil improvement and forage.

Black.—The term Black is a group name, including many similar black-seeded sorts which are rather commonly cultivated and succeed well under a wide diversity of conditions. For field purposes the varieties of this group are rather too viny and bear the pods too near the ground to harvest satisfactorily with a mower. If grown in corn they are excellent, and in some sections they are used for pasturing with hogs, as the seeds do not decay readily. In North Carolina, Arkansas, and southward the seeds are said to volunteer freely. A variety quite often grown as Black, Congo, or Early Black differs from the ordinary black sorts in being about 10 days earlier and having larger seeds.

Catjang.—The catjang, or Hindu cowpea (fig. 4), as it is sometimes called, is a group of cowpeas with erect half-bushy plants, small hard seeds, usually oblong or cylindrical, but slightly kidney shaped, and small pods 3 to 5 inches long, which are erect or ascending when green, remaining so when dry, or at length becoming spreading or even deflexed. The most vigorous and best of this group, unfortunately, are very late, and under American conditions at least are not very prolific. The Buff catjang is one of the best early sorts and has given favorable results in some sections of the Southern States.

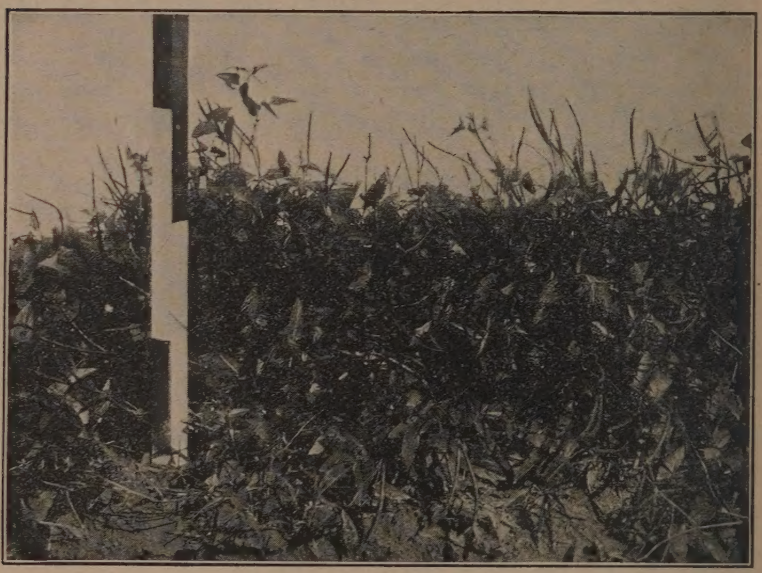

FIG. 4.—Catjang or Hindu cowpea plant, showing the mature pods.

Blackeye.—The Blackeye varieties are quite numerous and are very similar to each other, the name applying in general to all white sorts with a black eye. The varieties of this group have been grown as a table vegetable since ancient times. In some cases varieties of this group can be satisfactorily identified. One of the earliest forms is the Extra Early Blackeye, a sort adapted to the northern part of the cowpea region. The California Blackeye is grown quite extensively throughout the interior valleys of California.

White.—In this group of varieties the entire seed is creamy white except the sides of the seed scar or hilum and iris, which are sometimes greenish. All white varieties are very similar as to seed characters and are valued principally for table use, being only of secondary

value for forage. Among the sorts commonly grown as distinct varieties are the Conch and the Cream.

Asparagus bean.—The asparagus or yardlong bean (fig. 5) is a group of cowpeas with procumbent, very viny plants, very long (1 to 3 feet), inflated soft pods, and elongated kidney-shaped seed. Varieties of this group have long been used, especially in China and some European countries, as a snap bean, the young pods having an agreeable asparaguslike flavor. None of these beans can compare with the better varieties of the cowpea in production either of seed

FIG. 5.—Asparagus or yardlong bean plant, showing the pods.

or of forage. For the best results the asparagus bean requires the same sort of culture as ordinary pole beans. As a table bean, there is a place for the better varieties of this group. During the past few years, seed of a variety of this bean under the name Shahon pea has been sold at exorbitant prices.

FERTILIZERS.

Soils that are naturally unproductive or badly run down by continuous cropping should be properly fertilized in order to obtain the best results with cowpeas. Nitrogenous fertilizers on soils of good or moderate productiveness have little effect on either the yield or

the protein content of cowpeas. For the best results on very poor soils, however, 40 to 50 pounds of nitrate of soda to the acre or its equivalent in any other nitrogenous fertilizer should be applied. Phosphoric acid and potash in combination, or either alone, generally give a substantial increase in the yield of peas or forage. On soils in need of fertilizer, about 300 pounds of acid phosphate and about 50 pounds of potash to the acre should be applied when preparing the seed bed. As with most other legumes, lime has been found almost invariably to increase the yield of cowpeas. However, the cowpea is not benefited to the same extent by the use of lime as are red clover, alfalfa, and many other legumes.

PREPARATION OF THE SEED BED.

The cowpea will give fair results upon a poorly prepared seed bed, but the best results are to be obtained when the soil receives as careful preparation as for corn. Even if the crop is sown late in the spring, it is often desirable to plow the ground early and harrow the field at intervals to destroy weeds and to maintain a soil mulch to receive and retain the moisture. When sown as a catch crop after wheat or other small grains, if the land is clean and mellow, the seed bed may be prepared with a disk harrow or seeded with a single-disk drill without previous preparation.

INOCULATION.

Like other legumes, the cowpea is able to utilize the nitrogen of the air through the action of bacteria which live on the roots of the plant. If the cowpea has been grown in a locality for many years, the bacteria are plentiful and inoculation is not necessary. This is quite true throughout the Southern States. In new regions, however, especially in the North and West, when cowpeas are being grown for the first time, the soil should be inoculated from an outside source. Successful inoculation is shown by the development of nodules or tubercles on the roots (fig. 6) and may be secured by using a pure culture of the proper bacteria, a limited quantity of which may be obtained from the United States Department of Agriculture free of charge, or by dusting the cowpea seed with soil obtained from an old cowpea field known to have been inoculated, using about a gallon of soil to a bushel of seed. Inoculation experiments conducted by the Michigan Agricultural Experiment Station.[6] showed that cowpeas with root nodules contained 47 per cent more protein than those without nodules.

[6] Smith, C. D., and Robison, F. W. Observations on the influence of nodules on the roots upon the composition of soy beans and cowpeas. Mich. Agr. Exp. Sta. Bul. 224, p. 127–132. 1905.

TIME OF SOWING.

Cowpeas should not be sown until the soil has become thoroughly warmed and all danger of cold weather is past. After that time they can be sown whenever moisture conditions are favorable. When

FIG. 6.—Roots of a cowpea plant, showing the development of nodules.

sown in cold, wet soil, cowpea seed will either rot or give a poor stand of unhealthy plants. The latest date for profitable sowing, however, is at least 90 days before the first killing frost.

The time of sowing will depend largely upon the purpose for which the crop is grown. If grown for seed or hay, the seed should be

sown shortly after the corn crop. For green manuring, pasturage, or hay, cowpeas sown as late as the first of August in the South will make considerable growth. When cowpeas are to follow wheat or oats, they should be sown at the earliest possible moment after the crop is cut. The yield of forage and seed from the Groit variety, sown on different dates at Arlington Farm, Va., and Rocky Mount, N. C., and the New Era variety at Manhattan, Kans., is shown in Table I.

TABLE I.—*Yields per acre of the Groit and New Era varieties of cowpeas in time-of-sowing tests.*

Groit variety.					New Era variety.		
Date sown.	Arlington Farm, Va.		Rocky Mount, N. C.[1]		Date sown.	Manhattan, Kans.[2]	
	Hay.	Seed.	Hay.	Seed.		Hay.	Seed.
	Tons.	*Bushels.*	*Tons.*	*Bushels.*		*Tons.*	*Bushels.*
May 1	1.39	28	0.74	12.8	May 12	1.19	7.16
May 15	1.55	28	.94	16.0	May 19	2.00	10.32
June 1	1.58	29	1.09	17.1	May 26	2.00	9.91
June 15	1.80	19	1.17	14.3	June 3	2.26	10.68
July 1	1.74	12	1.25	15.4	June 9	2.08	11.59
July 15	1.10	5	.84	13.3	June 16	1.77	5.96
Aug. 1	.41	2			June 28	1.10	4.47

[1] Herman, V. R. Soy beans and cowpeas for North Carolina. N. C. Agr. Exp. Sta. Bul. 241, 40 p., 9 fig. 1919.
[2] Ten Eyck, A. M., and Call, L. E. Cowpeas. Kans. Agr. Exp. Sta. Bul. 160, p. 179–209, illus. 1909.

METHOD AND RATE OF SOWING.

The best method for the production of seed is to sow in rows about 3 feet apart, with the seeds from 2 to 3 inches apart in the row. Although a corn planter may be used for sowing in this way, the most practical method is to use the ordinary grain drill, stopping part of the grain cups so as to leave the rows about 3 feet apart and setting the drill the same as when sowing about 2 bushels of wheat to the acre.

When cowpeas are grown for forage or green manuring the seeds are sown broadcast or in drill rows 6 to 8 inches apart. (Fig. 7.) The grain drill set to sow about 1½ bushels of wheat to the acre will be found most satisfactory. If grown for silage with corn, the corn and cowpeas can be sown in one operation, using the ordinary corn planter. If cowpeas are sown in corn at the last cultivation, the common practice is to sow the seeds broadcast at the rate of 1 to 1½ bushels to the acre and cover them with a cultivator. (Fig. 8.) Another method is to sow with a 1-horse wheat drill at the rate of about 45 pounds to the acre, sowing two or three rows of cowpeas between the rows of corn. Cowpeas and corn are sometimes sown thickly together for hay with excellent results, using about one-half to 1

bushel of corn and 1 bushel of cowpeas to the acre. However, when corn makes a very heavy growth cowpeas will not give very good results on account of the shade and lack of moisture.

The quantity of seed to be sown to the acre varies according to the method of sowing. With rows 24 to 40 inches apart, about 30 to 40 pounds of seed to the acre will be required. When sown broadcast for hay, green manuring, or soiling, about 90 pounds of seed to the acre will be ample.

FIG. 7.—A field of cowpeas sown broadcast for hay.

Table II gives the average of method-of-culture tests covering three years at Arlington Farm, Va., with standard varieties in which the broadcasted plats were sown at the rate of 90 pounds, the 18-inch rows at the rate of 45 pounds, and the 40-inch rows at the rate of 30 pounds to the acre.

TABLE II.—*Average yields to the acre in method-of-culture tests with cowpeas at Arlington Farm, Va.*

Variety and method of culture.	Hay.	Seed.	Variety and method of culture.	Hay.	Seed.
Early Buff:	*Tons.*	*Bushels.*	Brabham:	*Tons.*	*Bushels.*
Broadcast	1.32	10.7	Broadcast	1.83	3.9
18-inch rows	1.32	13.3	18-inch rows	1.90	14.6
40-inch rows	1.18	15.9	40-inch rows	1.66	16.0
Whippoorwill:			New Era:		
Broadcast	1.98	4.5	Broadcast	.....	.....
18-inch rows	1.90	6.6	18-inch rows	1.52	16.4
40-inch rows	1.84	9.9	40-inch rows	1.26	15.3

CULTIVATION.

Under proper soil conditions cowpeas will germinate quickly and cultivation may begin early. When the seedlings first appear above the ground they are very tender and are easily broken, so that care must be exercised in working them. Usually the crop may be cultivated in two or three weeks after sowing. Ground sown to cowpeas is sometimes packed by heavy rains soon after sowing. A harrow or weeder can then be used advantageously to break the crust unless the seeds have germinated, when much damage may

FIG. 8.—Cowpeas grown with corn. Cowpeas are quite generally sown at the last cultivation of the corn for soil-improvement purposes.

result from harrowing. When sown in rows the ordinary implements used in corn cultivation will be found satisfactory, as the culture of cowpeas is essentially the same as for corn. About three cultivations at intervals up to the time the blossoms appear will usually be sufficient. If the ground is well cultivated and cleaned of weeds previous to sowing, broadcast sowings under favorable weather conditions grow rapidly and will smother any weeds which may start after sowing.

COWPEAS IN ROTATIONS.

Rotation of crops is one of the most important methods employed for maintaining or increasing yields of subsequent crops. The need for systematic rotations is quite apparent on most types of soil in

the cowpea region. It is a general rule that some leguminous crop, such as cowpeas, soy beans, alfalfa, or some of the clovers, should be included in all systems of rotation. The place of the cowpea in the rotation will depend largely on whether the crop is to be plowed under as a green manure or to be harvested for grain or hay. In one case it is sown as a catch crop after small grains and in the other in the spring as a regular crop. The cowpea succeeds under so many different conditions that it is especially valuable as a catch crop and for hay or seed production in almost any system of rotation.

A system of cropping practiced quite generally throughout the cotton belt allows the largest possible area to cotton, three years being given to this crop, the fourth year to corn and cowpeas, and then three years again to cotton. On the poorer soils of this region better results are obtained by growing cotton two years and corn and cowpeas the third year. In the sugar-cane districts of Louisiana excellent results are obtained by taking three crops of cane off the land and sowing to cowpeas or corn and cowpeas the fourth year.

In many sections of Missouri, Arkansas, and Tennessee a rotation of wheat or oats and cowpeas has given good results. On farms where live stock is kept the following rotation is very popular: First year, cotton; second year, corn, with cowpeas at the last cultivation; third year, winter oats or wheat, with a catch crop of cowpeas for hay or seed after the grain has been removed.

On the Black Lands of Texas one of the most successful rotations is: First year, wheat or oats; second year, cowpeas; third year, corn, milo, or sorghum; fourth year, cotton. The following rotations are recommended by the Oklahoma Agricultural Experiment Station:

No. 1.—First year, cotton; second year, cowpeas; third year, kafir or corn.
No. 2.—First year, corn; second year, cowpeas; third year, wheat or oats.
No. 3.—First year, cotton; second year, cowpeas; third year, oats or wheat.
No. 4.—First year, kafir; second year, cowpeas; third year, wheat or oats.

In those sections devoted to growing tobacco, the Virgina Agricultural Experiment Station recommends the following 7-year rotation: Tobacco, wheat, grass, grass, corn with crimson clover as a cover crop, cowpeas, and red clover. A good rotation in the corn belt on land where corn and wheat or oats are regularly grown consists of corn, soy beans, wheat, and clover, with cowpeas for hay when clover fails. Cowpeas are also to be recommended as a crop to precede alfalfa. The seed should be sown on land prepared the previous fall, as early in the spring as conditions permit. The cowpeas are cut for hay in July, after which the land can be prepared for alfalfa seeding in the fall.

COWPEAS IN MIXTURES.

Although the cowpea can be satisfactorily grown alone, it is more advantageously grown for hay in combination with other crops. When grown in this manner, not only is a greater variety and larger yield of feed obtained, but the mixed hay is much more easily cured and handled. Corn is used quite generally with cowpeas, but only to a slight extent for hay. The crop most widely used with cowpeas for hay is sorghum, both sweet sorghums and kafirs, although other crops, such as Sudan grass, Johnson grass, soy beans, and millet, are used.

COWPEAS AND CORN.

The cowpea is an excellent crop to grow with corn for silage, and it is being used extensively for this purpose on many dairy farms, especially in the northern part of the cowpea area.

If grown with corn for other than silage purposes, cowpeas are allowed to ripen a fair percentage of pods, which are gathered for seed and the remainder pastured. This method not only gives a crop of corn but also sufficient cowpea seed for sowing the next season, and the residue makes either a hay crop or a fair amount of grazing for stock. In many parts of the South, especially in the sugar-cane districts of Louisiana, cowpeas instead of being pastured are harvested for hay after the corn has been gathered.

COWPEAS AND SORGHUM.

Cowpeas grown in combination with sorghum make an excellent hay or silage crop (fig. 9). As a hay crop this mixture is more easily cured than cowpeas alone, constitutes a well-balanced ration, and is relished by all kinds of farm stock. Both the sweet sorghums and the kafirs are used. The Amber sorghum is most generally favored, especially in the Piedmont region of the South, while the kafirs are grown in the Southwest. When grown in rows, the Sumac and Orange varieties of sorghum are fully as good as the Amber, as they grow larger and stronger plants. The Whippoorwill, Iron, Unknown, and Clay varieties of cowpea require about the same time to mature as the sorghums and therefore should be used in place of the earlier sorts. In general, the planting should be from July 1 to 15. Harvesting with a mowing machine is most satisfactory.

When sown "broadcast" for hay, the sowing is best done with a grain drill on well-prepared land, the two kinds of seed being well mixed and sown at the same time. Usually the best rate to sow is about 1 bushel of cowpeas and half a bushel of sorghum seed to the acre. Where the grain drill is not available for sowing, the cowpea seed should be disked or harrowed in, and the sorghum should then

be sown while the land is rough, the seed being covered with a drag harrow or weeder.

Excellent results are obtained by sowing cowpeas and sorghums together in cultivated rows 2½ to 3 feet apart. This method requires about 45 pounds of cowpeas and about one-third of a bushel of sorghum seed to the acre.

If Johnson grass is not a pest or if it is well established on a field and there is no desire to eradicate it, it can be used very advantageously to form a part of a mixture with cowpeas. (Fig. 10.) Little

FIG. 9.—Cowpeas grown with sorghum. This makes an excellent hay mixture or may be used for ensilage purposes.

COWPEAS AND JOHNSON GRASS.

trouble will be encountered in killing Johnson grass north of Tennessee and central Virginia, but south of these States the difficulty is much greater. Wherever Johnson grass and cowpeas are used, excellent results are obtained, both in the yield and in the quality of hay produced.

This mixture should be sown at the rate of about 1 bushel of Johnson grass and 1 bushel of cowpeas to the acre. If sown with a grain drill, care must be taken to see that the Johnson grass seed is not covered too deeply. Where the grass is already established, the land may be either plowed or thoroughly disked in late spring, the treatment depending largely on the nature of the soil. The cowpeas in this case are sown alone in June. Usually about 1½ bushels of cowpea

seed are required, as the Johnson grass makes a much more vigorous growth from the rootstocks than when grown from seed.

COWPEAS AND SUDAN GRASS.

Sudan grass is an excellent crop for growing in combination with cowpeas for hay, being easily harvested and cured. It can be used without fear of its becoming a troublesome weed in those areas where Johnson grass is considered a pest. The best results are obtained by broadcast sowing, using about 50 pounds of cowpeas and 10 pounds of Sudan grass to the acre. The mixture is cut for hay about the time the cowpeas are ready for hay.

FIG. 10.—Cowpeas and Johnson grass combined for a hay mixture.

COWPEAS AND MILLET.

German, or Golden, millet is sometimes grown in mixture with cowpeas. The millet aids to a considerable extent in curing the hay and improves the quality by adding variety. As millet requires only a short time to mature, early varieties of cowpeas, such as the New Era, are most suitable for combining with it. With late and rank-growing varieties of cowpeas the results will not be satisfactory, as the millet matures early and is not sufficiently strong to support the vines.

COWPEAS AND SOY BEANS.

Cowpeas and soy beans afford a very satisfactory combination, either for hay or for pasture, and the yield is nearly always greater than that of either crop alone. Only the tall strong-growing varie-

ties of soy beans are desirable, as they assist very materially in supporting the viny cowpeas. Varieties of these crops maturing at about the same time should be selected. The hay of this mixture is of high feeding value, as both plants are rich in protein.

A mixture of soy beans and cowpeas should have more soy-bean plants than cowpeas, so that the cowpea vines may be properly supported. About 1 bushel of soy beans and half a bushel of cowpeas are required if "drilled broadcast," but if sown in rows 3 feet apart about half this quantity of each is sufficient. The sowing, whether broadcast or in cultivated rows, is best done with a grain drill.

In harvesting for hay, the best results are obtained if the mixture is cut when both plants are at the stage of growth when the best quality of hay may be produced. This is when the soy-bean seed is about full grown and the first pods of the cowpeas are mature. The harvesting of a mixture of cowpea and soy-bean hay is easier than a crop of cowpeas alone.

DISEASES OF THE COWPEA.[7]

Root-knot[8] and wilt[8] are the most serious diseases of the cowpea in the United States. Both troubles are primarily and most generally found in the sandy soils of the Southern States, and but rarely become serious on the heavier soils. Of the two diseases root-knot is the more general and widespread, and the losses from it are more severe.

Several other troubles of minor importance are white leaf-spot,[9] red leaf-spot,[10] and mildew.[11] These diseases are fairly common and widespread, but do not usually cause appreciable damage to the crop.

ROOT-KNOT.

Cowpea root-knot is the trouble most familiar to the farmer, because of the effect it has on the roots of the diseased plants. Instead of the normal, slender, tapering roots found on healthy plants, those attacked by root-knot have numerous irregular swellings, or galls, over the entire root system. They vary from small inconspicuous swellings to rough knotty enlargements an inch or more in diameter. At first they are the same color as the healthy roots, but they soon turn brown and decay, causing the serious injury or death of the roots. They are quite different from the small roundish nodules of the beneficial nitrogen-gathering organism, which rarely exceeds

[7] Prepared with the advice and cooperation of W. W. Gilbert, Pathologist, Office of Cotton, Truck and Forage Crop Disease Investigations, Bureau of Plant Industry, U. S. Department of Agriculture.

[8] Orton, W. A., and Webber, H. J. Some diseases of the cowpea. U. S. Dept. Agr. Bur. Plant Indus. Bul. 17, 38 p., 6 pl. 1902.

[9] Caused by the fungus *Amerosporium oeconomicum.*

[10] Caused by the fungus *Cercospora cruenta.* [11] Caused by the fungus *Erysiphe polygoni.*

one-fourth of an inch in diameter. These nodules are attached loosely to the roots, while the root-knot galls are enlargements of the roots themselves and can not be detached without breaking the roots.

Root-knot is caused by a tiny eelworm, or nematode,[12] which lives for the most part in the roots of cultivated crops. It bores its way into the young roots, secures its food from them, and so irritates the tissues that galls are produced. The formation of the galls not only uses up the food supply, but also interferes with its passage to the plant above and results in stunting or death. If one of the galls is broken open, the enlarged female nematodes can often be seen with the naked eye as pearly-white roundish bodies about the size of a pinhead.

The control of the root-knot is of vital importance in the South, because the cowpea is the principal leguminous crop used in rotations as a soil improver over great areas of country. The planting on infested land of cowpeas susceptible to root-knot not only results in poor crops of cowpeas, but does serious injury to crops susceptible to root-knot that follow by rapidly increasing the number of nematodes in the soil, whereas profitable rotations should be planned for the purpose of reducing this disease. A conspicuous example of the results of this bad practice is the common experience of farmers that cotton wilt is much more serious after a crop of cowpeas which are susceptible to root-knot, the reason being that the nematodes increase rapidly on the cowpeas, attack the cotton, and, by wounding its roots, make it more subject to wilt.

For intelligently planning suitable crop rotations for such root-knot infested fields it is essential to know the crops which may safely be planted, as well as those which should be avoided. Winter grains, corn, sorghum, velvet beans, four varieties of cowpeas (Iron, Brabham, Monetta, and Victor), and one of soy beans (Laredo) are immune to root-knot, while other farm crops for the most part are quite susceptible.[13]

The most effective and practical method of controlling root-knot combines the use of resistant varieties of cowpeas with the other known immune crops in the rotation. Susceptible varieties of cowpeas or other crops should not be planted on infested land until it has been rotated for one to three years with immune crops to starve out the nematodes.

WILT.

Wilt is characterized by a premature yellowing and falling of the leaves and the final death of the plants. The stems become yellow, the plants are stunted, and usually no fruit is set. Diseased stems

[12] *Heterodera radicicola.*

[13] For a full description of root-knot and its control, see Bessey, E. A., and Byars, L. P. The control of root-knot. U. S. Dept. Agr., Farmers' Bul. 648, 19 p., 20 fig. 1915.

are brown to black inside. The dead stalks of plants killed by wilt usually turn pink, owing to the presence of masses of the spores of the fungus which causes the disease. Wilt usually begins to make its appearance about midseason, and by August or September the plants in infested areas in the field may all be dead. The disease occurs in spots in the field, which enlarge from season to season until eventually the entire area may be affected. Wilt may be spread from field to field by drainage water, cultivation, animals, or any other agency which will carry some of the diseased soil.

Wilt is caused by a fungus which enters the roots from the soil, grows into and fills up the water-carrying vessels of the stems, and thus stops the passage of food and water to the plant, resulting in its wilting and death.

Wilt may be controlled by using varieties of cowpeas which are immune. Fortunately, the varieties known to be immune to root-knot are also highly resistant to wilt, and on infested land these should be planted to the exclusion of susceptible varieties.

INSECT ENEMIES OF THE COWPEA.[14]

The seed of cowpeas is subject to the attack of several species of weevil, the cowpea weevil[15] and the 4-spotted bean weevil[16] causing the most injury. The habits of both species, which are generally distributed throughout the Southern States, are practically identical. The weevil lays its eggs on the pods of the cowpea in the field and continues to breed for successive generations in the stored seed. The food value of the crop is often entirely destroyed or its value for planting purposes seriously impaired or destroyed. The larger seeds that have been attacked by two or three larvæ may germinate and make fairly good growth, although the seeds of smaller varieties may be ruined for planting by a single weevil.

The weevil may be very easily controlled if proper methods are employed in caring for the seed. It is impossible to prevent injury in the field. The best methods of control in the stored seed are the application of heat and fumigation with carbon bisulphid or hydrocyanic acid gas.[17]

In fumigating with carbon bisulphid, the seeds are placed in air-tight bins or receptacles and fumigated for at least 48 hours, using 1 pound of carbon bisulphid to 100 bushels of seed. The bisulphid is poured in shallow pans set on top of the seed or poured directly upon the seeds. As the carbon bisulphid volatilizes it forms a gas heavier

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[14] Prepared with the advice and cooperation of E. A. Back, Entomologist, Stored-Products Insect Investigations, Bureau of Entomology, U. S. Department of Agriculture.

[15] *Bruchus chinensis.* [16] *Bruchus quadrimaculatus.*

[17] Back, E. A., and Duckett, A. B. Bean and pea weevils. U. S. Dept. Agr., Farmers' Bul. 983, 24 p., 24 fig. 1918.

than air which sinks among the seeds. After fumigation, the seed should be thoroughly aired, as otherwise the germination may be affected. The treatment should be repeated in 10 days or two weeks in order to destroy all forms of the weevil not reached by the first application. In using carbon bisulphid, care must be exercised that it does not come in contact with fire of any kind, because of its high inflammability. Fumigation is not practicable at temperatures lower than 60° F., and is much more effective when the temperature is above 70° F.

Hydrocyanic-acid gas, which is not inflammable under ordinary conditions but most deadly poisonous and dangerous to human life if not carefully handled, is not so generally used.

The heat method, sometimes termed "kiln drying," consists of passing the seed over heated pipes or passing hot air through the mass of seed so as to subject to a temperature of 120° to 140° F.[18] One treatment is sufficient to kill all stages of the weevil, especially if the heat is applied sufficiently long to raise the entire bulk of the seed to at least 120° F. This can be done without injuring the germinating qualities of the seed.

A very simple method which is often employed with small lots consists in soaking the seed for one minute in boiling water. A longer period of time tends to injure the seed for planting. A modification of this remedy consists in placing the seed in cold water and gradually heating to 140° F., when the seed should be at once removed and spread out to dry.

In cold-storage experiments it was found that cowpea seed kept at temperatures as low as 26° to 31° F. for periods ranging from 58 to 184 days gave a germination of 86 to 95 per cent and varied little from the untreated seed kept as a check. The observations showed that when weevils in any of the stages in their life cycle are subjected to a temperature of 32° F. or below they will not mature.

The treatment of seeds which have been thinly and evenly spread on a canvas or floor by spraying with kerosene at the rate of 1 pint to 10 bushels of seed has been found beneficial. For spraying, an atomizer and spray pump or very fine sprinkler may be used, after which the seed should be shoveled so as to bring the treated and untreated seed together until all have an equal coating of the kerosene.

An application of air-slaked lime or road dust has been found very effectual for protecting stored cowpea seed from weevil damage. With 3 bushels or less, the best results were obtained by mixing the seed with an equal weight of slacked lime, while in lots up to 25 bushels 1 part of lime and 2 parts of seed were used. Where quanti-

[18] Chittenden, F. H. The cowpea weevil. U. S. Dept. Agr., Bur. Ent. Bul. 96, pt. 6, p. 84–94, fig. 21, pl. 1. 1912.

ties greater than 25 bushels are to be stored, using 1 part of lime to 8 of cowpeas and then covering the seed with a half-inch layer of lime was found effective. The seed should be kept dry, in order that the lime may not injure the viability. If desired, the seeds can be sifted before planting, while if they are to be used for feed or human food the lime can be easily washed from seeds from which no weevils have emerged. When seeds contain weevil holes before they are placed in the lime, the lime fills the cavity and is removed with great difficulty.

The foliage of cowpeas is more or less subject to attack by various insects, but this damage is seldom serious.

COWPEAS, SOY BEANS, AND VELVET BEANS COMPARED.

Cowpeas, velvet beans, and soy beans are all summer annuals, agriculturally much alike, and for the best results are adapted to nearly the same regions. A comparison of these crops is not so much a matter of determining which is the best crop as it is a careful consideration of their climatic and soil adaptations and the special uses of each on the farm. Among the important points that determine the value of a leguminous crop are its value for forage, both in quantity and quality, either as hay or pasture; its ability to supply additional nitrogen; and the value of the seed as a cash crop or for its utilization on the farm.

The soy bean has about the same climatic adaptations as corn, and therefore its culture is much more extended than that of either the cowpea or velvet bean. The velvet bean is especially adapted to the well-drained portions of the Atlantic and Gulf Coastal Plain areas, while the cowpea can be grown successfully not only there, but throughout the cotton belt and the lower half of the corn belt. The velvet bean and cowpea are quite sensitive to cold, whereas the soy bean withstands considerable frost in spring and fall. Cowpeas and velvet beans both succeed on poor soils better than the soy bean. For soil improvement the velvet bean is, in general, superior to either the cowpea or the soy bean, although the cowpea succeeds under a greater diversity of conditions.

The soy bean is to be preferred for forage purposes on account of its upright growth. The cowpea and velvet bean are viny plants and therefore more difficult to harvest and cure.

As a grazing crop for cattle and hogs in fall and winter the velvet bean can not be excelled. However, the cowpea and soy bean can be grown over a more extended area, and some of their numerous varieties furnish earlier pasture.

For the production of seed, the soy bean has many advantages over the cowpea and velvet bean. The soy bean matures all its seed at

one time and can easily be handled by machinery. Hand picking is most commonly practiced in gathering cowpea seed, although machinery can be used to advantage. It is necessary to pick velvet beans by hand because of the abundant, tangled mass of vines.

The seeds of velvet beans, cowpeas, and soy beans are all excellent feed for cattle and hogs. Cowpea seed, however, is rarely cheap enough for feed, but it is extensively used, especially in the Southern States, for human food. Soy-bean seed, in addition to its value for feed, is valuable for the production of oil and meal, and its use for human food is increasing.

The cowpea will undoubtedly continue to be one of the most important leguminous crops in the Southern States. No other crop sown under such a diversity of conditions or receiving so little attention in soil preparation and cultivation succeeds so well. Under the most varied conditions forage, soil improvement, and human food are obtained.

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